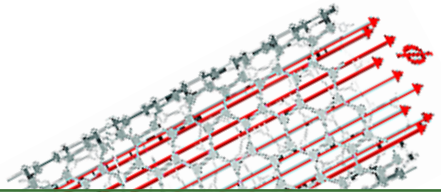
MPA material matters

April 2007

Newsletter of the Materials Physics and Applications Division

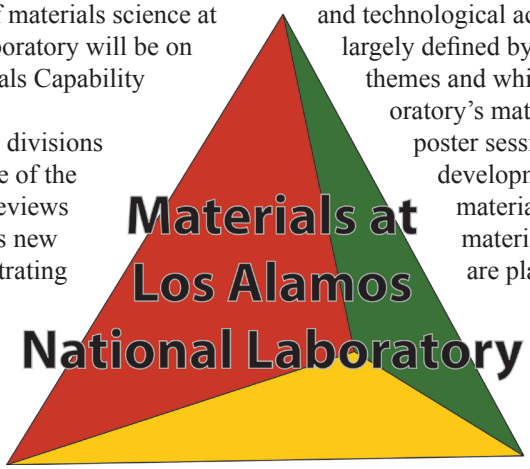


Capability Review to focus on strength of Laboratory's materials science

The strength and vitality of materials science at Los Alamos National Laboratory will be on display during the Materials Capability Review, to be held May 16-18.

More than 25 groups from 10 divisions will participate in the event—one of the first external capability-centric reviews to be held under the Laboratory's new management structure—demonstrating the comprehensiveness of Los Alamos' materials program.

These new reviews, of which there are approximately five planned per year, support the Laboratory's goal of being a capabilities-based national security science laboratory.



Charged with evaluating the quality of science within the materials capability, a distinguished 10-member review committee from universities and national laboratories and chaired by Anthony Rollett of Carnegie Mellon University, will be presented with recent science and technological accomplishments in five theme areas, largely defined by the Grand Challenge Workshop themes and which represent a subset of the Laboratory's materials program. Presentations and poster sessions highlighting recent research developments in materials dynamics, actinide materials, multi-scale modeling, designed materials, and new characterization tools are planned. These theme areas will be reviewed on a three year cycle with future reviews focusing on other themes areas to be determined.

The review, being organized by the Experimental Physical Sciences Associate Director, will be held in the Jemez Room at the Study Center, with classified sessions in the Weapons Meeting Room of the Administration Building.

Members of the Los Alamos materials community are invited to attend the sessions. Look for the final agenda to be posted on the EPS website, http://int.lanl.gov/orgs/adeps/.

MPA-11's Sinha is principal investigator in two new Alliance for Advanced Energy Solutions projects

The Alliance for Advanced Energy Solutions between Chevron and Los Alamos National Laboratory recently announced the initiation of five new projects at the Laboratory.

Two of the recently executed projects feature MPA-11's Dipen Sinha as a principal investigator—acoustic drilling optimization and nonlinear acoustic reservoir imaging.

In the acoustic drilling optimization project, the Laboratory and Chevron will investigate the use of advanced acoustic sensor technology to monitor the drilling process in operation.

This is important from the perspective of improving well yields and hence to national energy security. The total value of the project is more than $2 million.

In the nonlinear acoustic reservoir imaging project, Los Alamos and Chevron will investigate the use of the Laboratory's advanced acoustic sensor technology for imaging geologic formations near the well bore.

Knowledge of the way the rock around the well changes during oil extraction is critical to increasing the recovery of oil from the well.

Sinha and Paul Johnson, EES-11, are principal investigators. The total value of the project is more than $2 million.

Other projects include cement substitutes; geo-mechanical reservoir simulator bore stress; and hollow fiber separations, in which Los Alamos and Chevron will explore the operational parameters and economic feasibility of replacing the conventional tray-type distillation towers in petroleum refineries with hollow fiber membranes. The Los Alamos principal investigator is MST-7's Dali Yang.

This increases the number of projects under the Alliance to 12 projects. Technology Transfer Division manages the Alliance.

Chevron Corporation ranks among the world's largest and most competitive global energy companies and is one of the Laboratory's strongest industrial research partners.

Headquartered in San Ramon, CA and active in more than 180 countries, it is engaged in every aspect of the oil and gas industry.

INSIDE this issue

From John's desk

Materials Physics and Applications: Causes for optimism spring forth

Let me begin with an apology. I'm sure that last week's supplemental "From the Desk" emphasizing the LDI survey, travel expectations, and classification review guidance, and in which I hailed the arrival of spring played a role in our recent wet and cold snap. Hopefully, it was our last gasp of winter and we can now look forward to a warmer spring and summer. If you haven't read this supplemental "From the Desk" information, I hope you will soon.

The calendar also tells us that we've reached the half-way point of our first fiscal year under our new management contract. A principal focus of my and your group leaders' time in recent weeks has been preparing for our AD-EPS mid-year financial and staffing review, which occurred on April 11.

I must begin my comments on this with a note of gratitude and congratulations to all of you. We are remarkably sound financially (and technically) both in the short term and the longer term, and all of you deserve a significant amount of credit for these successes. Keep up the good work!

Nationally, there's growing interest and attention being placed on science solutions to energy challenges, and it's inevitable in such a situation that external sponsors look to MPA. Our best estimates indicate that MPA will have an $80M budget by year end, up as much as 20% from our initial estimates just post-transition, with most of our growth due to advances in DOE's Office of Energy Efficiency and Renewable Energy and CRADA/licensing agreements with a number of external corporate partners.

I'm also happy to report that MST and P Divisions have made significant strides in mitigating the funding challenges that have arisen due to reduced Weapons Program funding. I strongly encourage all of us to remain frugal and fiscally conservative as we work through a remarkably challenging funding cycle.

Our financial success is directly coupled to your technical success, and I'd like to remind you to share your technical success stories with your group management as well as Karen Kippen, our communications leader—it's really quite easy for your and your co-workers' work to be featured in *Materials Matters* or stand-alone research or facility highlights, but you've got to help us take the first steps down this path by sharing your highlights.

Our relative fiscal stability creates an opportunity, and in my mind, an obligation to think hard about the long term. A number of us, myself included, have bemoaned our lack of an institutional energy security strategy. I would like to highlight a few key steps that we are taking to address this and challenge all of you to become a part of the solution. Quite soon, Terry Wallace will post a job ad for Deputy Principal Associate Director for Science, Technology, and Engineering. The selected individual will be key in championing our energy strategy.

In addition, we are currently seeking an MPA Deputy Division Leader who, in addition to helping me, will have principal responsibility for leading AD-Experimental Physical Sciences' Directorate-wide energy strategy. I have asked Toni Taylor, CINT Center Leader, to chair a search and screening committee with the goal of filling this current vacancy quite soon.

In my opinion, filling these two key leadership positions will further invigorate our Energy Council, on which I am the AD-EPS representative, to articulate key science questions and programmatic strategies to bolster our efforts in these essential areas. However, management and process can only go so far, and this is where I need your help. Building on the efforts of many of you during the Grand Challenge Workshops, we will shortly announce a planning process to go beyond these first steps and fully articulate a vision (and associated barriers to achieving this vision) for "Materials for Energy."

I would very much like to hear your thoughts on our current strengths (and weaknesses) in this mission area, as well as key opportunities and strategic threats.

—MPA Division Leader John Sarrao

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"Spin"

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E. Garlid, J. Zhang, K. Reddy, S. Flexner, C. Palmstrom, and P. Crowell at the University of Minnesota, and by Scott Crooker at MPA-NHMFL, appears in *Nature Physics* **3**, 197 - 202 (2007). The work was supported by the Office of Naval Research, the National Science Foundation MRSEC (Materials Research Science and Engineering Centers), National Nanotechnology Infrastructure Network and Integrative Graduate Education and Research Traineeship Programs and the Los Alamos LDRD program.

MPA staff delivers new scientific results at 2007 American Physical Society Meeting

The Materials Physics and Applications Division actively participated in the 2007 American Physical Society Meeting in Denver.

Giving invited talks were MPA-10's Tuson Park on "Field-induced Magnetism and Quantum Criticality in Superconducting CeRhIn5 under Pressure," MPA-NHMFL's Vivien Zapf on "Quantum Magnetism and Possible BEC (Bose Einstein Condensate) in an Organic Nickel Compound," and MPA Division Leader John Sarrao on "Superconductivity: Challenges and Opportunities," which was part of a symposium promoting DOE-Office of Basic Energy Science's effort on Basic Research Needs for Superconductivity.

In addition to Park's invited talk, MPA-10 group members presented 12 contributed talks on such topics as quantum criticality in correlated electron systems, f-electron duality, novel superconductivity, the inhomogeneous superconducting FFLO (Fulde-Ferrell-Larkin-Ovchinnikov) state in pure and doped $CeCoIn_5$, and magnetic resonance force microscopy. MPA-STC gave eight talks at the meeting.

Stroh to serve on Western Governor's Alternative Transportation Fuels Implementation Team

Ken Stroh

MPA-11's Ken Stroh has been nominated to serve on the Hydrogen/Fuel Cell Team for implementation of the Western Governor's Association Policy Resolution 06-02, "Transportation Fuels for the Future."

The Alternative Fuel Teams (ethanol, biodiesel, coal-to-liquids, electric hybrid-plugins, hydrogen/fuel cell and compressed natural gas) will develop reports on the current state of development and challenges; financial and technical needs for commercialization; pros and cons of specific fuels; and ideas for actions to expedite development.

These reports will be the basis for a workshop to gather broader input, leading to a report and presentation to the Governors in December.

Stroh was nominated by Sarah Cottrell, New Mexico Governor Bill Richardson's Energy and Environment Policy Advisor.

MPA-11 contributes to energy collaboration workshop

Cathy Padro

MPA-11's Ken Stroh and Cathy Padro recently participated in an Energy Collaboration Workshop at the University of California, Davis sponsored by the UC Davis Office of Research and the National Research Council Canada. More than 50 participants from six University of California campuses, two University of California national laboratories, four Canadian universities, the National Research Council Canada and Natural Resources Canada discussed collaborative research opportunities in biomass/biofuels, hydrogen and fuel cells, and socio-economic issues.

MPA-11 Group Leader Ken Stroh led the hydrogen and fuel cells breakout group. A number of near-term action items were developed in each area, and a follow-up meeting is scheduled for late June in Edmonton, Alberta.

Celebrating service

Lacerda invited to serve on Center for Nanophase Materials Sciences Division Advisory Committee

Alex Lacerda

MPA-NHMFL Center Leader Alex Lacerda has been invited to serve on Oak Ridge National Laboratory's Center for Nanophase Materials Sciences (CNMS) Division Advisory Committee for 2007-2008. The committee focuses on interactions with technical staff in specific fields of research and will provide input to the center's strategic plan regarding the science and evolution of its scientific themes.

Heads UP, MPA!

Custodial Support FAQ

Given the recent changes to custodial support in buildings maintained by MC-FOD, the following is a list of frequently asked questions.

Who do I call if I find the restrooms in poor condition? *The Facility Coordinator for your area. Contact info can be found at http://int.lanl.gov/orgs/mcfod/documents/mcfod_geossign_03-19-07.pdf*

Who do I call when the trash collection bins become overflowing? *The Facility Coordinator for your area.*

Where do I find extra supplies and vacuums if I need them? *Custodial closets are open, otherwise contact your Facility Coordinator.*

What are we suppose to do with food products, I don't want to dump them in the trash collection bins?
Food products should be placed in the lunchroom areas of buildings where there are designated trash cans for food. These trash cans are dumped at least twice a week. Normal trash should never be placed in this area.

When will my room be vacuumed?
All floors and hallways are to be cleaned once per week. MC-FOD will establish a schedule so you know when this will happen so you can leave your door open.

It is unsafe for floors in high hazard buildings to be done once per week. *High hazard areas like BTF will have the same cleaning frequency as before.*

Feeling stressed?

The Laboratory's Wellness Center offers a variety of programs to help manage stress. Upcoming classes include "Taking it in Stride: Coping with Change," to be held May 2 at noon; "Self Leadership, Communicating Your Personal Policies & Procedures," May 18 at 2 p.m.; "Introduction to Meditation," May 23 at noon; and "Stress Management to Relax the Mind and Body," May 11 at 2 p.m.

Heavy lifting

Knowing and practicing proper lifting procedures is important and can help prevent injuries. That's the message of the newest Safety Short, a series of timely, concise topics to help everyone at the Laboratory stay safe at work and at home.

The Web-based Safety Short provides a video and a flier, as well as other tools. View these at http://int.lanl.gov/safety/safetyshort/.

In addition, a Toolkit for Safety Meetings helps people in presenting the Safety Short during organizational safety meetings, tailgate meetings, and Nested Safety and Security meetings.

Identity theft

Identity theft occurs when someone uses your name or personal information, such as your social security number, driver's license, credit card, telephone or other account numbers, without your permission.

With this information, identity thieves can open credit, bank, and utility service accounts, and make major purchases—all in your name. Identity theft can result in damage to your credit rating and denials of credit and job offers.

Read more about identity theft at the latest Security Smart at http://int.lanl.gov/security/documents/security-smart/identity_theft0407.pdf.

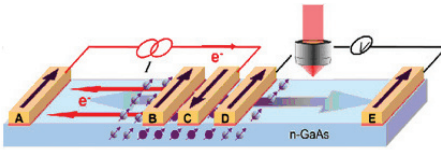
Heads UP, MPA! reports on environment, safety, and health, security, and facility-related news and information.

Got news?

MPA Material Matters features technical highlights developed each week for the Director's Office. If you have unclassified news you'd like to see featured, please send it to your group leader to be forwarded to *MPA Material Matters* Editor Karen Kippen.

Electrical detection of spin transport in lateral ferromagnet-semiconductor devices

Research in *Nature Physics*



Schematic of the spin transport device

The development of semiconductor spintronics requires a reliable electronic means for writing, processing, and reading information using spin-polarized carriers. Researchers from the University of Minnesota and from MPA-NHMFL have recently demonstrated a fully electrical scheme for achieving injection, transport and detection of spin-polarized electrons in a single semiconductor device.

Their device consists of a lateral semiconductor (GaAs) channel with two ferromagnetic (Fe) contacts, one of which serves as a source of spin-polarized electrons and the other as a detector. Electrical spin detection in the device is achieved through a spin-sensitive, Schottky-tunnel-barrier Fe/GaAs contact used in a 'non-local' device geometry (ie, no current flows through the detection electrode). The electrochemical potential measured at this detection electrode depends on the relative magnetizations of the source and detector, as well as on the spin polarization of the free electrons in the GaAs under the detector.

The researchers verified the effectiveness of this approach by showing that a small transverse magnetic field suppresses the non-local signal at the detection contact by inducing spin precession and dephasing of the electrons in the GaAs channel (the Hanle effect). Further, the sign of the signal varies with the injection current and is correlated with the spin polarization in the GaAs channel as independently determined by optical Kerr rotation measurements.

The work, "Electrical detection of spin transport in lateral ferromagnet–semiconductor devices," by X. Lou, C. Adelmann,

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